

REMARKS

The present amendment is in response to the Office Action mailed November 20, 2002, in which Claims 1 through 17 and 20 through 32 were rejected. Applicants have thoroughly reviewed the outstanding Office Action including the Examiner's remarks and the reference cited therein. The following remarks are believed to be fully responsive to the Office Action and, when coupled with the amendments made herein, are believed to render all claims at issue patentably distinguishable over the cited references.

Claims 1, 24 and 30 are amended herein. No claims are cancelled. No claims are added. Accordingly, Claims 1 through 17 and 20 through 32 remain pending.

All the changes are made for clarification and are based on the application and drawings as originally filed. It is respectfully submitted that no new matter is added.

Applicants respectfully request reconsideration in light of the above amendments and the following remarks.

CLAIM AMENDMENTS – IN GENERAL

Claims 1, 24 and 30 are amended to more clearly define the present invention. More particularly, Claims 1, 24 and 30 have been amended to define the (propylene) polymer as being isotactic. Support for this change may be found, for example, on page 3, lines 34 and 35 of the specification as originally filed. Accordingly, Applicants respectfully submit that no new matter has been added by these changes.

CLAIM REJECTIONS – 35 U.S.C. SECTION 102(b)

With respect to Paragraph 3 of the Office Action, the Examiner rejected Claims 1, 3, 9, 10, 12, 13, 14, 16, 20 through 25, and 30 under 35 U.S.C. Section 102(b) as being

unpatentable under U.S. Patent No. 6,159,612 to Chu *et al.* (hereinafter referred to as "Chu *et al.*")

Applicants respectfully traverse these rejections.

Chu *et al.* defines a an oriented multi-layer film that comprises a base layer comprising an isotactic polypropylene and a barrier layer adjacent the base layer comprising a syndiotactic polypropylene and "oxygen permeability reducing amounts of wax." Conversely, and as amended for clarification herein, the present invention is directed to a film comprising a base layer that comprises an isotactic polypropylene polymer and a combination of a resin and a wax. There are significant differences between isotactic polypropylene and syndiotactic polypropylene, so that this distinction is more than simply a design choice. Accordingly, it cannot be said that Chu *et al.* anticipates the invention as set forth.

Moreover, Applicants respectfully submit that it is incorrect to suppose that Chu *et al.* teach the combination of wax and hydrocarbon resin in one layer. There is a generic teaching that any of the layers disclosed by Chu *et al.* could contain any of the additives mentioned in col. 4, lines 2 to 9. The disclosure of Chu *et al.* does not give any preference for any specific combination, let alone any hint to the combination of wax and low molecular weight resin in the syndiotactic layer. The generic teaching of adding any of these additives without giving any specific guidelines as to *where* to add which additive for whatever reason, does by no means anticipate the specific combination of wax and hard resin for improving the barrier properties.

Accordingly, Applicants respectfully request that the Examiner's rejections under 35 U.S.C. Section 102(b) be reconsidered and withdrawn.

CLAIM REJECTIONS – 35 U.S.C. SECTION 103(a)

1. Claims 1 through 17 and 20 through 32

With respect to Paragraphs 4, 5 and 6 of the Office Action, the Examiner rejected Claims 1 through 17 and 20 through 32 under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent No. 5,246,769 to Murschall *et al.* (hereinafter referred to as “Murschall *et al.*”) in view of U.S. Patent No. 5,155,160 to Yeh *et al.* (hereinafter referred to as “Yeh *et al.*”) or WO 96/27491 (hereinafter referred to as “WO 491”).

Applicants respectfully traverse these rejections.

One of the objects of the present invention was to improve barrier properties of polypropylene films. Applicants respectfully submit that Murschall *et al.* is not even remotely related to barrier films, and thus is related to an entirely different set of problems, such as transparency, gloss, scratch resistance, runability, and so on.

Applicants submit that the primary reference, to qualify as such in a rejection, must be directly relevant to the rejected invention. Murschall *et al.* is absolutely silent about barrier properties and therefore is an improper primary reference.

Moreover a combination of wax and hard resin cannot be derived from Murschall *et al.* The same arguments as outlined above in relation to Chu *et al.* apply here with equal strength. There are three layers and a variety of additives. The teaching is generic in suggesting any combination. Such a generic disclosure does not anticipate a specific combination.

The Examiner finds it obvious to utilize - in addition to the hydrocarbon resin in the base layer - a conventional lubricant-like wax. Murschall *et al.* disclose the addition of a wax as a lubricant, amongst other lubricants mentioned in the same paragraph. Murschall *et al.* does not even disclose that hard resin improves the barrier. This

disclosure cannot be said to motivate a skilled artisan to combine hard resin and the wax with a reasonable expectation of an improved barrier, and Applicants respectfully submit that the reliance on this disclosure and the conclusions drawn therefrom are based entirely – and improperly - on hindsight. Murschall *et al.* do not give any hint as to how to improve the barrier of the film. Murschall *et al.* recommends a lubricant. No skilled artisan would reasonably derive from a suggested lubricant that such lubricant interact in a synergistic way with another additive which is not a lubricant at all.

The Examiner combines Murschall *et al.* with Yeh *et al.* and WO 491 and argues that these secondary references teaches the barrier as improving the effect of waxes. This combination is improper since the primary and the secondary reference teach different films and different kinds of waxes. Murschall *et al.* teach waxes which are lubricants. In order to act as a lubricant the wax has to migrate to a significant extent to the surface of a film, otherwise it will not have any effect on the slippage properties of the film. Yeh *et al.* teach that their barrier improving wax do not migrate to the surface. Therefore a skilled artisan following the teaching of Murschall *et al.* will not use the waxes of Yeh *et al.*, since Yeh *et al.* explain that their waxes do not migrate to the surface (please refer to Yeh *et al.*, col. 3, lines 58 – 65). Therefore the artisan would find the waxes of Yeh *et al.* useless as a lubricants suggested by Murschall *et al.* This outcome underscores why the use of Murschall *et al.* as a primary reference is not well-founded.

2. Claims 1 through 17 and 20 through 32

With respect to Paragraphs 7, 8 and 9 of the Office Action, the Examiner rejected Claims 1 through 17 and 20 through 32 under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent No. 6,068,936 to Peiffer *et al.* (hereinafter referred to as “Peiffer *et al.*”) in view of Yeh *et al.* or WO 491.

With respect to Paragraph 10 of the Office Action, the Examiner rejected Claims 1, 3, 9, 10, 12, 13, 14, 16, and 20 through 25 under 35 U.S.C. Section 103(a) as being unpatentable over Chu *et al.* in view of Peiffer *et al.* or Murschall *et al.*

Applicants respectfully traverse these rejections.

With respect to Peiffer *et al.*, Applicants respectfully submit that this use of this reference is entirely misplaced. Clearly a cycloolefin polymer cannot be classified as a wax. This is confirmed by the specification of Peiffer *et al.* which mentions in the same manner as Murschall *et al.*, that a possible lubricant is a wax. Since waxes are suggested as additional lubricants they cannot be encompassed by the term cycloolefin copolymers.

Applicants observe that all of the arguments presented by the Examiner are based upon the assumption that the **combination of wax and hard resin in one layer has been disclosed previously by the primary reference.** Applicants respectfully submit that this assumption is entirely incorrect and the proposed combinations of references cannot be derived by reference to Murschall *et al.*, even relying upon hindsight. Without knowing about the teachings of the present invention no skilled artisan would read from Murschall *et al.* a combination of wax and hard resin in one layer. If anything can be derived from Murschall *et al.* it could be perhaps a combination of hard resin and a lubricant. But starting with such a combination a skilled artisan would not use the waxes of Yeh *et al.* as lubricants in the film of Murschall *et al.* since the waxes of Yeh *et al.* are not lubricants insofar as the waxes of Yeh *et al.* are explicitly disclosed as being non-migrating.

This seems to be a typical “could/would” situation, where Murschall *et al.* **at best** confirm that the skilled artisan could choose the combination, since waxes and hard resins were, in principal, known as film additives. But there is no suggestion and no

indication as to *WHY* a skilled artisan would choose exactly this combination, let alone any hint as to the use of any specific waxes of a specific molecular weight to achieve a better barrier.

Furthermore, the combination of Murschall *et al.* with Yeh *et al.* or WO 461 would not lead the skilled artisan to the invention, even if such a combination was proper. A skilled artisan starting with Murschall *et al.* (any unlikely scenario given this references failure to provide a relevant teaching in the art of barrier films of the present invention as claimed) would at best take the polypropylene film of Murschall *et al.* and add the waxes of Yeh *et al.* to receive the barrier properties of Yeh *et al.* But there is no reason whatsoever in the teachings of either in Murschall *et al.* or in Yeh *et al.* as to *why* to the wax of Yeh *et al.* should be combined with the hard resin disclosed in Murschall *et al.*

Conversely, if one were to start with a film from Murschall *et al.* having a hard resin and wax as alleged by the Examiner a skilled artisan would not use the wax of Yeh *et al.* as the lubricant as explained above in view of the predicted lack of migration. Finally, if one were to choose from the various Murschall *et al.* embodiments involving a hard resin-modified film, a skilled artisan would not modify such a film additionally with a wax as disclosed in Yeh *et al.*, because the skilled artisan would conclude: *"I have already achieved the best barrier I can achieve because of the use of the hard resin. Why would wax improve this outcome? Rather, the best I can expect from adherence to the teachings of Yeh et al. would be less than what I have already achieved."*

Applicants respectfully submit that the situation would be clearer if some historical background on the state of the barrier film art at the time of the development of the present invention was provided. Specifically, polypropylene films and how its barrier can be improved was (and, by the way, still is) as follows. Polypropylene films are known for having amorphous and crystalline regions. The amorphous regions are believed to be

the weak spots impairing the barrier. The optimum would be to have a 100% crystalline polypropylene film for having the best barrier which polypropylene can theoretically provide. (Unfortunately such a polypropylene does not exist and moreover it could not be worked into a biaxially oriented film, since with growing crystallinity the stretchability of polypropylene decreases.) In view of the amorphous regions in a biaxially oriented polypropylene film the skilled artisan would seek to identify the correct material to fill these amorphous regions. Hard resin are (and were) known to serve this purpose in a very effective way. The understanding was that the barrier is improved by the resin through migration of the resin into the amorphous regions of the polypropylene film. Accordingly the prior art teaches the modification of the biaxially oriented polypropylene films by adding hard resins if the barrier is to be improved.

The teachings of Yeh *et al.* and WO are based on the same understanding, but they provide the filling of the amorphous regions with wax. Along these lines the Examiner's attention is respectfully drawn to col. 1, lines 58 to 62, of Yeh *et al.*:

"Even the most crystalline polyolefins have some amorphous regions. It is further believed that the wax crystallizes in the amorphous regions of the polyolefin and that this phenomena explains the significant improvement in barrier properties."

Yeh *et al.* explain that the interaction between the wax and the amorphous regions is important. Therefore they recommends that the amount of wax be adapted in view of the amorphousness of the polyolefin (col. 2, lines 41 - 44).

In a similar way WO 491 tries to avoid the loss of wax, but suggest instead to keep it in the film by providing cap layers (page 9, line 30 - 32):

"... and providing on each side of the core layer a polyolefin cap layer, to provide a multilayer film, whereby loss of wax from the film is avoided."

Page 12, lines 20-25:

"The inventive procedure avoids the loss of wax originally present in the core layer by the provision of cap layers that control the rate of wax migration during orientation."

From this detailed analysis of the prior art teaching one can derive the following understanding of a skilled artisan at the time the invention was made. First, the skilled artisan understood very well the differences between lubricants and barrier-improving waxes. A wax functioning as a lubricant has nothing to do with a wax functioning as a barrier. The amount of wax used is also different. Specifically, whereas for wax-lubricants the range is between 0.1% and 2.5% (Murschall *et al.* col. 4, lines 46 - 50), the barrier effect of the wax starts with at least 1.0%, depending on the crystallinity of the polyolefin. Even though there is some overlap the ranges are different. The kind of wax used for lubricity is different from barrier waxes. As a *lubricant* the wax has to migrate to the surface, it has to come out of the film, whereas as a *barrier* the wax has to stay in the film.

At the time the invention was made the theory about barriers, waxes and hard resins was that the respective additives migrate into the amorphous regions of a polyolefin where they crystallize and thereby reduce the barrier of the film. The fact that wax and hard resin additive (taken alone) provide similar barrier values to a polyolefin film confirmed the understanding that the mode of action of each is similar. Specifically, once the amorphous regions have been filled with either the wax or the hard resin the

best possible or maximum improvement has been achieved. One cannot lower the transmission further by adding even more material. In other words, up to a certain amount of hard resin or wax the respective ingredient *does* have an improving effect on the barrier, but once this concentration is exceeded any additional amount does not contribute to further improvement, because the amorphous regions are filled up to a maximum.

That this is the case may be confirmed by referring to Fig. 1 of Yeh *et al.* which demonstrates that after exceeding a maximum amount of wax the barrier is even *impaired*. The Applicants found similar results in that more than 5.0% wax did not lower the transmission values any further. (Please see Applicants' comparative data.) Starting from plain biaxially oriented polypropylene the water vapor barrier according to our measurements is 0.37 or 1.28 (depending on the conditions). The transmission is lowered by wax to 0.3 at 3.0% wax and to 0.24 at 5.0% wax. More than 5.0% wax did not lower the transmission value below about 0.24. (This finding is consistent with the results of Yeh *et al.*) Similar with hard resin transmission could be reduced to 0.27 at 8.0% resin and to 0.25 at 10.0% resin. Again with additional hard resin you reach asymptotically a minimum value of slightly below 0.25, may be at best 0.22 with very high amounts of hard resin, such as in the region of 20.0%. Accordingly, it is clear that one cannot lower the transmission below about 0.24 with EITHER wax OR hard resin because the amorphous regions are filled.

This was the starting point for the present invention. One of the objects was to further reduce the barrier properties of a film, which barrier was already very good. (Again underscoring the inappropriateness of the citing of Murschall *et al.* as the primary reference.) Applicants found two very surprising (and unpredictable) effects: If, for example, one takes the film having 10.0% resin, one could not improve the barrier of this

film any further with more hard resin, but it *can* be improved further by adding a wax.

The opposite, Applicants found, is also true. If one took the film with 5.0% wax the barrier of this film cannot be improved any further with more wax, but the barrier can be improved further by adding a hard resin. It was very surprising to discover that the transmission values could be lowered below the minimum reached before, namely below the minimum values of about 0.25/0.24. With the combined additives extremely low transmission rates of 0.19/0.17/0.12 (please see Examples 3, 2 and 6) could be achieved.

Importantly, Applicants found that the effect of the combination of wax and hard resin on the barrier is different from the action of the wax or the hard resin acting alone. The combination is better in that lower transmission rates are achieved than you could achieve before and, significantly it is better in that you need less additive in sum for the same barrier improvement. These results are clearly demonstrated by the examples and comparative examples: 8.0% + 3.0 % makes 0.18 (Examples 3 or 9) whereas 10.0% makes 0.25 (CE 7, hard resin) or 0.24 (CE10 minimum with wax).

Thus it is clear that Applicants have discovered results which are not taught, suggested, or otherwise made obvious in the teachings of the prior art, whether taken alone or standing in combination. More particularly, to derive from a combined reading of Murschall *et al.* and Yeh *et al.* this effect in an obvious manner would be nothing more than hindsight. Murschall *et al.* is an improper closest prior art, because it is not related to barrier films at all. Murschall *et al.* does not teach the combination of barrier waxes and hard resin.

In Paragraph 11 the Examiner states that she would reconsider her position if Applicants could show unexpected results with regards to the instantly claimed molecular weight ranges. In Claim 1, for example, Applicants define the resin as having a mean

molecular weight Mw of from 600 to 1500 and a wax having a mean molecular weight Mn of from 200 - 700. The hydrocarbon resin used in the examples according to the invention always have a Mw of 1000 right within the claimed range while the wax used in the examples according to the invention always have a Mn of 500, which is also within the claimed range. Comparative Example 3 (Table 2, page 26 of the specification) compares with the Example 3 (Table 1, page 25 of the specification) according to the invention. Another wax is used in Comparative Example 3, which differs in that the molecular weight is Mn=1000 instead of 500, which is outside the claimed range. Tables 1 and 2 show that according to the invention the transmission rate is 0.19 or 0.62, whereas with the overly-high molecular weight of the wax transmission rates of only 0.28 and 0.97 are achieved. The same applies to Comparative Example 4 demonstrating that an overly-high molecular weight of the hard resin does not provide the desired improvement. In general, Applicants have achieved unexpected results in the development of the present invention whereby, in addition to the surprising effect on the molecular weight, the fact that the combined additives interact differently on the barrier when compared with the single additives is a surprising effect which cannot be derived by any combination of the cited prior art.

Applicants respectfully submit that these comparative examples demonstrate the requisite showing of unexpected results. However, Applicants would be willing to provide data further demonstrating unexpected results with regards to the molecular weight if deemed necessary.

Reconsideration and withdrawal of the rejections under 35 U.S.C. Section 103(a) are respectfully requested.

MARKED-UP CHANGES


Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached paper is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE.**"

CONCLUSION

In light of the above amendments and remarks, Applicants respectfully submit that all pending claims as currently presented are in condition for allowance. If, for any reason, the Examiner disagrees, please call the undersigned attorney at 202-624-3947 in an effort to resolve any matter still outstanding *before* issuing another action. The undersigned attorney is confident that any issue which might remain can readily be worked out by telephone.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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TTM/hs



VERSION WITH MARKINGS TO SHOW CHANGES MADE
(USSN 09/601,790)

IN THE CLAIMS:

Claims 1, 24, and 30 are amended as follows:

1. (Twice amended) A multilayer, biaxially oriented polypropylene film comprising a base layer and at least one heat-sealable top layer, wherein said base layer comprises (i) [a] an isotactic propylene polymer and (ii) a combination of a hydrocarbon resin and a wax, said resin having a mean molecular weight MW of from 600 to 1500 and said wax having a mean molecular weight Mn of from 200 to 700.

24. (Once amended) A process for the production of oriented polypropylene films having an improved water vapor barrier action, which comprises compressing [a] an isotactic polymer or [a] an isotactic polymer mixture, said polymer or polymer mixture containing a resin having a mean molecular weight Mw of from 600 to 1500 and a wax having a mean molecular weight Mn of from 200 to 700.

30. (Once amended) A multilayer, biaxially oriented polypropylene film comprising a base layer and at least one heat-sealable top layer, wherein said base layer comprises (i) [a] an isotactic propylene polymer and (ii) a combination of a resin and a wax, wherein said resin being a hydrocarbon resin, fully or partially [hedrogenated] hydrogenated, having a softening point of 80°C or above and having a mean molecular weight Mw of from 600 to 1500; and

said wax being selected from the group consisting of polyethylene waxes, macrocrystalline paraffin waxes, microcrystalline paraffins and mixtures thereof and having a mean molecular weight M_n of from 200 to 700.